

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended) A cartridge for purifying a liquid chemical, comprising:

(a) a conduit connected to receive a flow of a chemical to be purified, wherein the chemical to be purified comprises a chemical selected from the group consisting of a hydrogen peroxide solution, hydrofluoric acid, hydrochloric acid, acetic acid, ammonium hydroxide solution and combinations thereof; and

(b) a packed section in the conduit comprising a purification material, wherein the ratio of the length of the packed section to the inside diameter of the conduit is from about 8:1 to about 200:1, and wherein the flow of the chemical to be purified contacts the purification material, thereby producing a flow of a purified chemical, wherein the purified chemical has a cationic concentration of less than or equal to about 1 ppb per cationic contaminant, and an anionic concentration of less than or equal to about 10 ppb per anionic contaminant.

Claim 2 (cancelled)

Claim 3 (currently amended) The cartridge according to claim 2 1, wherein the chemical to be purified comprises the hydrogen peroxide solution, and wherein the purification material reduces the amount of a contaminant selected from the group consisting of an organic contaminant, a cationic contaminant, an anionic contaminant and combinations thereof, in the chemical to be purified upon contact therewith.

Claim 4 (original) The cartridge according to claim 1, wherein the ratio of the length of the packed section to the inside diameter of the conduit is from about 15:1 to about 50:1.

Claim 5 (original) The cartridge according to claim 4, wherein the ratio of the length of the packed section to the inside diameter of the conduit is about 25:1.

Claim 6 (original) The cartridge according to claim 1, wherein the length of the packed section is from about 16 to about 50 inches.

Claim 7 (original) The cartridge according to claim 6, wherein the length of the packed section is about 25 inches.

Claim 8 (original) The cartridge according to claim 1, wherein the inside diameter is from about 0.25 to about 2 inches.

Claim 9 (original) The cartridge according to claim 8, wherein the inside diameter of the conduit is about 1 inch.

Claim 10 (currently amended) The cartridge according to claim 1, wherein the cartridge is formed from ~~a material selected from the group consisting of PFA, TEFLON® and the combination thereof.~~

Claim 11 (original) The cartridge according to claim 1, wherein the length of the packed section is shorter than the length of the conduit.

Claim 12 (original) The cartridge according to claim 1, further comprising at least one screen for maintaining the purification material in the conduit.

Claim 13 (original) The cartridge according to claim 1, wherein the conduit is connected to a fluid-providing line at one end thereof and a product line at

another end thereof, wherein the diameters of the conduit, fluid-providing line and product line are equal.

Claim 14 (original) The cartridge according to claim 1, wherein the conduit is connected to a fluid-providing line at one end thereof and a product line at another end thereof, wherein the conduit, the fluid-providing line and the product line are coaxially arranged.

Claim 15 (withdrawn) A method for purifying a liquid chemical, comprising introducing the flow of the chemical to be purified to the cartridge of claim 1.

Claim 16 (withdrawn) The method according to claim 15, wherein the flow rate of the chemical to be purified in the cartridge is from about 0.05 to about 20 liters per minute.

Claim 17 (withdrawn) The method according to claim 16, wherein the flow rate of the chemical to be purified in the cartridge is from about 2 to about 5 liters per minute.

Claim 18 (withdrawn) The method according to claim 15, wherein the chemical to be purified comprises a chemical selected from the group consisting of a hydrogen peroxide solution, hydrofluoric acid, hydrochloric acid, acetic acid, ammonium hydroxide solution, water and combinations thereof.

Claim 19 (original) An apparatus for purifying a liquid chemical, comprising:

- (a) a chemical source for providing a main flow of the chemical to be purified; and

- (b) a plurality of the cartridges according to claim 1, wherein the plurality of the cartridges is connected to receive the main flow of the chemical to be purified.

Claim 20 (original) The apparatus according to claim 19, wherein the apparatus comprises a part of a semiconductor manufacturing facility.

Claim 21 (original) The apparatus according to claim 19, wherein the plurality of the cartridges comprises a plurality of groups of the cartridges connected in parallel, wherein each group of the cartridges comprises three cartridges connected in series.

Claim 22 (original) The apparatus according to claim 21, wherein each group of the cartridges comprises a first cartridge comprising an organic contaminant-reducing purification material, a second cartridge comprising an anionic contaminant-reducing purification material, and a third cartridge comprising a cationic contaminant-reducing purification material.

Claim 23 (original) The apparatus according to claim 19, wherein the chemical to be purified comprises a chemical selected from the group consisting of a hydrogen peroxide solution, hydrofluoric acid, hydrochloric acid, acetic acid, ammonium hydroxide solution, water and combinations thereof.

Claim 24 (original) The apparatus according to claim 23, wherein the chemical to be purified comprises the hydrogen peroxide solution.

Claim 25 (original) The apparatus according to claim 19, wherein for each cartridge, the ratio of the length of the packed section to the inside diameter of the conduit is from about 15:1 to about 50:1.

Claim 26 (original) The apparatus according to claim 25, wherein for each cartridge, the ratio of the length of the packed section to the inside diameter of the conduit is about 25:1.

Claim 27 (original) The apparatus according to claim 19, wherein the length of the packed section of each cartridge is from about 16 to about 50 inches.

Claim 28 (original) The apparatus according to claim 27, wherein the length of the packed section of each cartridge is about 25 inches.

Claim 29 (original) The apparatus according to claim 19, wherein the inside diameter of the conduit of each cartridge is from about 0.25 to about 2 inches.

Claim 30 (original) The apparatus according to claim 29, wherein the inside diameter of the conduit of each cartridge is about 1 inch.

Claim 31 (currently amended) The apparatus according to claim 19, wherein each cartridge is formed from ~~a material selected from the group consisting of PFA, TEFLON® and the combination thereof.~~

Claim 32 (original) The apparatus according to claim 19, wherein for each cartridge, the length of the packed section is shorter than the length of the conduit.

Claim 33 (original) The apparatus according to claim 19, wherein each cartridge further comprises at least one screen for maintaining the purification material in the conduit.

Claim 34 (withdrawn) A method for purifying a liquid chemical, comprising introducing the main flow of the chemical to be purified to the plurality of the cartridges of the apparatus of claim 19.

Claim 35 (withdrawn) The method according to claim 34, wherein the flow rate of the chemical to be purified in each cartridge of the apparatus is from about 0.05 to about 20 liters per minute.

Claim 36 (withdrawn) The method according to claim 35, wherein the flow rate of the chemical to be purified in each cartridge of the apparatus is from about 2 to about 5 liters per minute.

Claim 37 (withdrawn) The method according to claim 34, wherein the chemical to be purified comprises a chemical selected from the group consisting of a hydrogen peroxide solution, hydrofluoric acid, hydrochloric acid, acetic acid, ammonium hydroxide solution, water and combinations thereof.

Claim 38 (withdrawn) A detachable fitting for connection to a fluid transport line, comprising:

- (a) a conduit having an inlet end for receiving a flow of fluid from a fluid-providing line and an outlet end for introducing the flow of fluid to a fluid-receiving line;
- (b) a first connection device arranged to removably connect the inlet end of the conduit to the fluid-providing line;
- (c) a second connection device arranged to removably connect the outlet end of the conduit to the fluid-receiving line; and
- (d) a device disposed inside the conduit, wherein the flow of fluid contacts the device.

Claim 39 (withdrawn) The detachable fitting according to claim 38, wherein the conduit is formed of a material selected from the group consisting of PTFE, PFA, polypropylene, polyvinyl difluoride TEFLON and combinations thereof.

Claim 40 (withdrawn) The detachable fitting according to claim 38, wherein the device disposed inside the conduit is selected from the group consisting of a screen, a membrane and a filter.

Claim 41 (withdrawn) The detachable fitting according to claim 38, wherein the device is removable from the conduit.

Claim 42 (withdrawn) The detachable fitting according to claim 38, wherein the fluid is a liquid.

Claim 43 (withdrawn) The detachable fitting according to claim 38, wherein the inlet and outlet ends of the conduit are respectively inserted into flanged ends of the fluid-providing line and the fluid-receiving line.

Claim 44 (withdrawn) The detachable fitting according to claim 38, wherein the first connection device comprises a threaded section arranged to removably connect the inlet end of the conduit to the fluid-providing line.

Claim 45 (withdrawn) The detachable fitting according to claim 38, wherein the second connection device comprises a threaded section arranged to removably connect the outlet end of the conduit to the fluid-receiving line.

Claim 46 (original) The cartridge according to claim 1, wherein the chemical to be purified is further comprised of a hydrogen peroxide solution.

Claim 47 (canceled)

Claim 48 (new) A cartridge for purifying a liquid chemical, consisting essentially of:

- (a) a conduit connected to receive a flow of a chemical to be purified, wherein the chemical to be purified comprises a chemical selected from the group consisting of a hydrogen peroxide solution, hydrofluoric acid, hydrochloric acid, acetic acid, ammonium hydroxide solution and combinations thereof; and
- (b) a packed section in the conduit comprising a purification material, wherein the ratio of the length of the packed section to the inside diameter of the conduit is from about 8:1 to about 200:1, and wherein the flow of the chemical to be purified contacts the purification material, thereby producing a flow of a purified chemical, wherein the purified chemical has a cationic concentration of less than or equal to about 1 ppb per cationic contaminant, and an anionic concentration of less than or equal to about 10 ppb per anionic contaminant.

Claim 49 (new) A cartridge according to claim 1, wherein the purification material comprises at least one resin.

Claim 50 (new) A cartridge for purifying a liquid chemical, comprising:

- (a) a conduit connected to receive a flow of a chemical to be purified, wherein the chemical to be purified comprises a chemical selected from the group consisting of a hydrogen peroxide solution, hydrofluoric acid, hydrochloric acid, acetic acid, ammonium hydroxide solution and combinations thereof; and
- (b) a packed section in the conduit comprising a resin purification material, wherein the ratio of the length of the packed section to the inside diameter of the conduit is from about 8:1 to about 200:1, and wherein the flow of the chemical to be purified contacts the resin purification material, thereby producing a flow of a purified chemical,

Appl. No. 09/824,771
Amdt. dated September 10, 2003
Reply to Office Action of April 10, 2003

wherein the purified chemical has a cationic concentration of less than or equal to about 1 ppb per cationic contaminant, and an anionic concentration of less than or equal to about 10 ppb per anionic contaminant.